

REMARKS

The Official Action dated October 7, 2008 has been carefully considered. Accordingly, the present Amendment is believed sufficient to place the present application in condition for allowance. Reconsideration is respectfully requested.

By the present Amendment, claims 1 and 12 are amended to include thermal shrinkage and oxygen permeability limitations from original claims 3, 6 and 16 and the specification at page 10, lines 18-22 and page 28, lines 2-12. Claims 1 and 12 are also amended to recite that the layer (a) is formed of a poly(carboxylic acid) polymer (A) and is "free of polyalcohol." Support for this limitation is found in the specification at page 16, lines 2-5, wherein polyalcohols (polyvinyl alcohol and glycerin) are disclosed as optional components, i.e., they may be included or omitted, whereby the claims are limited to the embodiment wherein such polyalcohols are omitted. Claims 21 and 22 are added, support for which may be found in the specification at page 23, lines 21-26. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, claims 1-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over the Ohba PCT Publication WO 99/52973 (the Examiner referring to its English language equivalent U.S. Patent No. 6,605,344) in view of the Bekele U.S. Patent No. 5,482,770. The Examiner asserted that Ohba teaches a gas barrier film produced by applying a metallic compound to the surface of a poly(meth)acrylic polymer layer, wherein a polymer layer may be applied to the metallic compound layer and a heat sealable layer may be applied to the outer polymer layer (referring to the disclosure at column 10 of the U.S. Patent). The Examiner asserted that the polymer layer reads on the claimed base film and the heat sealable layer reads on the claimed heat sensitive tackifier of claim 18 and the additional layer of claim 9. The Examiner acknowledged that Ohba does not teach that the film is heat

shrinkable. However, the Examiner relied on Bekele as teaching that it is desirable for barrier packaging films to be heat shrinkable. The Examiner asserted that Bekele discloses that films are made heat shrinkable by orienting the film and then heating the film so that it returns to its pre-oriented state. The Examiner concluded it would have been obvious to orient the film of Ohba in view of the teachings of Bekele.

However, Applicants submit that claims 1, 4, 5, 7-15 and 17-20 are nonobvious over and patentable distinguishable from the combination of Ohba and Bekele. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

More particularly, the present invention is directed to a multi-layer film which is both heat shrinkable and exhibits excellent oxygen barrier properties. As defined by claim 1, the multi-layer film comprises a heat-shrinkable base film and, provided on at least one surface of the base film, at least one layer structure including a layer (a) formed of a poly(carboxylic acid) polymer (A) and free of polyalcohol, and a layer (b) formed of a polyvalent metal compound (B), the layers (a) and (b) being in contact with each other. The multi-layer film and the base film each exhibit a percent thermal shrinkage in at least one direction of 5 to 90% as measured by immersing the respective film in hot water at 90°C for 30 seconds and the multilayer film exhibits an oxygen permeability of $500 \text{ cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80%. Claim 12 recites a similar multi-layer film wherein the layer (b) is formed of a resin containing the polyvalent metal compound (B).

The multi-layer films of the present invention are distinguishable from the teachings of Ohba, and the combination of Ohba and Bekele, in several important respects. First, the layer (a) in claim 1 of the present application is “free of polyalcohol”, while, in contrast, the polymer layer disclosed in Ohba is “produced from a mixture of polyalcohol and at least one poly(meth)acrylic acid polymer” (Abstract). According to Ohba, the polymer layer is subjected to a heat treatment, for example by passing the layer through an oven which is

heated at a predetermined temperature for a predetermined time, or by bringing the layer into contact with a heat roll, and, after completion of the heat treatment, the resultant polymer layer has water resistance, i.e., the resultant polymer layer is insoluble in water or boiling water, and exhibits excellent gas-barrier properties under high humidity (column 9, lines 47-56). Ohba's examples show the polymer layer was subjected to heat treatment for 30 minutes at 160°C, for 120 minutes at 160°C, for 15 minutes at 180°C or for 30 seconds at 230°C. The heat treatment time becomes longer as the heat treatment temperature becomes lower. One of ordinary skill in the art will appreciate that the poly(meth)acrylic acid polymer is esterified with the polyalcohol and a crosslinked structure is introduced into the polymer layer by the esterification reaction. Ohba show experimental examples where a polyalcohol such as polyvinyl alcohol, sugar or glycerol is used in a proportion of 10-40 wt.% to form a polymer layer (Tables 1 to 3). Immersing such polymer layers, without having conducted a heat treatment, in water or boiling water will cause the polyalcohol to dissolve or swell, so that a gas-barrier film excellent in water resistance and oxygen gas barrier property is not provided.

On the other hand, in present claims 1 and 12, a multi-layer film excellent in water resistance and oxygen gas barrier property is provided only by migration of the polyvalent metal compound (polyvalent metal ion) from the layer (b) into the layer (a) formed of a poly(carboxylic acid) polymer, resulting in an ionically crosslinked structure by a reaction between the poly(carboxylic acid) polymer and the polyvalent metal ion, without a heat treatment and without introducing an ester linkage between the polycarboxylic acid and a polyalcohol as required by Ohba. In the heat-shrinkable multi-layer film according to the present invention, the ionically crosslinked poly(carboxylic acid) polymer does not dissolve and/or swell, even when the film is immersed in hot water at 90°C, and moreover the oxygen gas barrier property is improved.

Second, while the presently claimed multi-layer films include a heat-shrinkable base film, Ohba does not disclose that a heat-shrinkable film is used as a base film. To the contrary, Ohba discloses, for example, oriented polyethylene terephthalate (O-PET) or oriented nylon (O-Ny) for use as a base material. As well-known in the art, these oriented films are heat-set at a high temperature under tension after an orientation treatment in the production process. The heat set, oriented films are reduced in heat shrinkability and are substantially not shrunk even when immersed for 30 seconds in hot water at 90°C. If Ohba were to employ a heat shrinkable film as a substrate, in place of the disclosed base material, the heat treatment necessary to render the polymer layer water resistant would cause the heat shrinkable layer to shrink, therefore rendering the Ohba film unsuitable for applications requiring a heat shrinkable property. On the other hand, if the Ohba polymer layer which is rendered water resistant by heat treatment, resulting in the esterification crosslinking, is combined with a heat-shrinkable film to impart heat shrinkability, it is probable that the crosslinked structure of the polymer layer is destroyed upon heat shrinking, thereby reducing the water resistance of the layer, and/or separation between the polymer layer and the heat-shrinkable film occurs, thereby lowering the oxygen gas barrier property. Thus, merely replacing the base material of Ohba does not result in the claimed multi-layer films.

Third, the heat-shrinkable multi-layer film recited in claim 1 of the present application has an oxygen permeability of $500 \text{ cm}^3/(\text{m}^2 \cdot \text{day} \cdot \text{MPa})$ or less as measured at 30°C and a relative humidity of 80% and exhibits this excellent oxygen gas barrier property without subjecting the film to a heat treatment at a high temperature. In contrast, Ohba discloses that when the heat treatment is conducted, good water resistance is imparted to the polymer layer and a gas-barrier film having excellent oxygen gas barrier property as demonstrated by an oxygen permeability of $400 \text{ cm}^3/\text{m}^2 \cdot 24\text{h} \cdot \text{atm}$ or less as measured at 30°C and 80% RH for a polymer layer of 2 μm in thickness is provided (column 9, lines 37-41). This 400

$\text{cm}^3/\text{m}^2 \cdot 24\text{h} \cdot \text{atm}$, which is Ohba's upper limit of the oxygen permeability, corresponds to about $4,000 \text{ cm}^3/\text{m}^2 \cdot \text{day} \cdot \text{MPa}$ because of $1 \text{ atm} = 101 \text{ kPa} = 0.101 \text{ MPa}$. To the contrary, $500 \text{ cm}^3/\text{m}^2 \cdot \text{day} \cdot \text{MPa}$, which is the upper limit of the oxygen permeability of the heat-shrinkable multi-layer film recited in claims 1 and 12 of the present application, corresponds to $50 \text{ cm}^3/\text{m}^2 \cdot 24\text{h} \cdot \text{atm}$. When both upper limits are compared, it appears that the gas-barrier film in Ohba permeates oxygen in a larger amount than the heat-shrinkable multi-layer film of the present claims. In fact, Ohba exemplifies a polymer layer formed of a mixture of polyalcohol and at least one poly(meth)acrylic acid polymer with a thickness of $2 \mu\text{m}$. On the other hand, the Examples of the present specification show that the thickness of a layer (a) formed of a poly(carboxylic acid) polymer (A) is extremely thin, i.e., $0.3 \mu\text{m}$. Therefore, it is apparent that the oxygen gas barrier property of the heat-shrinkable multi-layer film in claim 1 of the present application is excellent.

Thus, as described above, the heat-shrinkable multi-layer films of claims 1 and 12 exhibit excellent oxygen gas barrier properties without conducting a heat treatment as disclosed in Ohba and without introducing an ester linkage (crosslinked structure by esterification) by heat treatment with a polyalcohol at a high temperature. Ohba provides no teaching or suggestion of a multi-layer film exhibiting such a combination. The deficiencies of Ohba are not resolved by Bekele. That is, while Bekele teaches it is desirable for barrier packaging films to be heat shrinkable, Bekele does not disclose or suggest coating a heat-shrinkable base film with a barrier layer or provide any other apparent reasoning for modifying the teachings of Ohba to result in the presently claimed multi-layer films.

More particularly, Bekele disclose a production process for an oriented multilayer film, comprising the steps of (1) extruding and quenching a tape comprising a barrier composition and an orientation-compatible composition, and (2) orienting the tape at an orientation ratio of from about 9 to 20 and at a temperature of from about 165°F to about

212°F so that a multilayer film having a barrier layer and at least one orientation-compatible layer is formed (column 3, lines 10-17). Thus, Bekele discloses that orientation (stretching) is conducted on the multi-layer film, including the barrier layer, to impart heat shrinkability. If one of ordinary skill in the art would have combined this teaching of Bekele with Ohba, one skilled in the art would, at best, orient the gas-barrier film containing a polymer layer as taught by Ohba, in which a crosslinked structure has been formed. As discussed above, the water resistance provided by the heat treatment (i.e., the crosslinked structure) and/or the gas barrier properties are probably deteriorated by such an orientation (stretching), and a heat shrinkable multi-layer film with the presently claimed oxygen permeability barrier property is not obtained.

In determining patentability under 35 U.S.C. §103, it is necessary to determine whether there was an apparent reason to combine the known elements of the prior art in the fashion of the claims at issue, *KSR International Co. v. Teleflex, Inc.*, 127 S.Ct. 1727, 1740-41 (2007). Here, the combination of Ohba and Bekele does not provide an apparent reason for combining their teachings in a manner which results in the claimed multi-layer films having heat shrinkability and excellent oxygen barrier properties. Accordingly, the combination of Ohba and Bekele does not render the claimed multi-layer films obvious. The rejection under 35 U.S.C. §103 is therefore overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the Official Action, and places the present application in condition for allowance. Reconsideration and an early allowance are requested.

Please charge any fees required in connection with the present communication, or credit any overpayment, to Deposit Account No. 503915.

Respectfully submitted,

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